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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/472,757	12/27/1999	ROBERT J. O'DONNELL	LAM133/P0582	9169

22434 7590 03/12/2002

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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 03/12/2002

9

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/472,757

Applicant(s)

O DONNELL, ROBERT J.

Examiner

Lynette T. Umez-Eronini

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) 16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-15, 17 and 18 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☒ Claim(s) 16 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I in Paper No. 8 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 18 rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. On lines 1-3, "wherein the stripping away comprises accelerating oxygen plasma to the substrate to remove parts of the metal-containing layer that are redeposited to form residual sidewall passivation" is not described in the Specification. It is unclear what is done to accelerate the plasma or whether the claim requires specified process conditions for accelerating the plasma.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh et al. (US 5,776,832) and further in view of Brown et al. (US 5,780,359).

Hsieh teaches applying a photoresist to a substrate, which is exposed through an etch mask **20** and forming the etch mask over portions of a metal layer **18** where the metal conducting lines are desired (column 4, line 60 – column 5, line 2). The aforementioned reads on a method of etching partially through a metal-containing layer disposed above a substrate, wherein part of the said metal-containing layer is disposed below an etch mask and part of the said metal-containing layer is not disposed below the etch mask.

Anisotropically plasma etching the metal layer in a reactive ion etcher (column 5, lines 9-17) by using a chlorine-containing gas or gas mixtures such as BCl_3 and Cl_2 , which results in the formation of AlCl_3 on the Al sidewalls (same as applicant's residual sidewall passivation) and metal side wall polymer (column 3, lines 9-13 and 24-26) reads on the method comprises the steps of:

Placing the substrate in an etch chamber;

Flowing and etchant gas into the etch chamber;

Creating a plasma from the etchant gas in the etch chamber; and

Etching away parts of the metal-containing layer not disposed below the etch masks, wherein some of the etched away parts of the metal-containing layer is redeposited to form residual sidewall passivation while the substrate is in the etch chamber.

Hsieh teaches "unlike the more conventional etch process of the prior art which uses CF_4 and CHF_3 to remove the residues and stringers **5** as depicted in **FIG 4**, the present invention utilizes an oxygen plasma ashing (step 3) . . ." (column 5, lines 30-33) and "in situ oxygen ashing at zero substrate bias in said etching chamber immediately after said patterning of said metal layer and prior to removing said substrate from said etching chamber, thereby passivating said metal interconnections by removing chlorine residue and removing residual polymers on said patterned metal sidewalls . . ." as recited in claim 1, which read on:

- Discontinuing the flow of the etchant gas into the etch chamber;
- Flowing the etch mask stripping gas in the etch chamber; and
- Removing the substrate from the etch chamber.

Hsieh differs in failing to teach creating a plasma from the etch mask stripping gas in the etch chamber.

Brown teaches "the photoresist and residue (same as applicant's metal-containing layer that is redeposited to form residual sidewall passivation) are processed simultaneously by a chemical mechanism comprising reactive species derived from a microwave-excited fluorine-containing downstream gas, and a physical mechanism

comprising ion bombardment that results from a radio frequency excited plasma and accompanying wafer self bias" (Abstract), which reads on creating a plasma from the etch mask stripping gas into the etch chamber.

Hence, it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Hsieh by using the method of Brown to create a plasma from the etch mask stripping gas for simultaneously removing photoresist and polymer residue from a wafer surface.

6. Claims 2-14, and 17, are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh ('832) in view of Brown ('359) as applied to claim 1 above, and further in view of Fukuyama et al. (US 5,770,100) and Tepman et al. (US 5,186,718).

Hsieh differs in failing to teach electrostatically attracting the plasma from the etch mask stripping gas to the substrate in the etch chamber, **in claim 2**.

Brown teaches "Once the reactive species are introduced into the process chamber (or, alternatively, as they are introduced therein), radio frequency energy (RF) is applied to the wafer chuck, causing the wafer chuck to function as a cathode. The RF energy strikes a plasma in the chamber and around the wafer. The polymer residues situated on the sidewalls and top surface of the post-metal etch wafer are thus not only chemically stripped with the microwave-excited downstream gas, but are also subjected to ion bombardment as a result of RF induced wafer self bias" (column 3, line 19-28), which read on electrostatically attracting the plasma from the etch mask stripping gas to the substrate in the etch chamber.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Hsieh by using electrostatically attracting plasma from the etch mask stripping gas to the substrate in the etch chamber as taught by Brown for the purpose of preventing contamination of the wafer by particles generated from polymer residues during the stripping process.

Hsieh differs in failing to teach:

placing the substrate in and removing the substrate from a load lock, **in claim 6** and

placing the substrate into a corrosion passivation chamber after the substrate has been removed from the etch chamber, and exposing the wafer to a non-plasma high temperature water vapor, **in claim 7**.

Fukuyama teaches an anticorrosion treatment using a load lock system (Figure 1) to transfer a wafer from an etching chamber to a post-etch treatment chamber 8, where anticorrosion treatment of sample is carried out using vaporized gas of water (column 3, line 61 – column 4, line 21 and column 8, lines 41-54).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Hsieh by moving and removing the substrate from a load lock, placing a sample into a corrosion passivation chamber after the substrate has been removed from the etch chamber and carrying out the anticorrosion passivation in as taught by Fukuyama for the purpose of preventing contamination in the processing chamber.

Hsieh differs in failing to teach: transferring the substrate from the corrosion passivation chamber to a cooling station; cooling the substrate in the cooling station; and transferring the substrate from the cooling station to the load lock, **in claim 8**.

Tepman teaches using the load lock system for transferring wafers and using either post etching chamber **26** and **27** for cooling wafers following treating in a processing chambers **34** (column 4, lines 23-29). It is noted that the processing chambers **34** is not limited to only etching and ashing. Other processes such as anti-corrosion treatment can be performed in chambers **34**.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Hsieh by using a load lock system to transfer a substrate from a processing chamber to a cooling station and to a load lock as taught by Tepman for the purpose of preventing contamination in the processing chamber.

Hsieh differs in failing to specify processing variables such as the etchant pressure of 1 and 80 millitorr during the stripping step, as recited **in claims 9 and 12** and a bias power between -10 and -1000 volts during the step of electrostatically attracting the plasma from the etchant gas and the stripping gas.

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to employ any of a variety of operational variables such as temperature and pressure as claimed by the applicant. They are well-known variables in the etching art and known to affect both the rate and quality of the etching process. Conducting routine experimentation for the purpose of obtaining the best polymeric

composition would optimize the selection of a particular value. Changes in temperature, concentrations, or other process conditions of an old process do not impart patentability unless the recited ranges are critical, i.e., they produce a new and unexpected result. *In re Aller et al.*, 105 USPQ 233.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claim 15 is rejected under 35 U.S.C. 102(b) as being anticipated by Hsieh ('832).

Hsieh teaches applying a photoresist to a substrate, which is exposed through an etch mask **20** and forming the etch mask over portions of a metal layer **18** where the metal conducting lines are desired (column 4, line 60 – column 5, line 2). The aforementioned reads on a method of etching partially through a metal-containing layer disposed above a substrate, wherein part of the said metal-containing layer is disposed below an etch mask and part of the said metal-containing layer is not disposed below the etch mask.

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Placing the substrate in an etch chamber;

Etching away parts of the metal-containing layer not disposed below the etch masks, wherein some of the etched away parts of the metal-containing layer is redeposited to form residual sidewall passivation while the substrate is in the etch chamber.

Table 1 shows the etching flow rate and time of the etching gases are set at zero when oxygen ashing is carried out to remove residue and stringers as depicted in Figure 4 (column 5, lines 29-48) and to remove portions of the photoresist mask (column 6, lines 6-8) prior to removing the substrate from the etching chamber (claim 1, lines 5-8), which reads on:

Striping away the etch mask and removing some sidewall passivation while the substrate in the etch chamber; and

Removing the substrate form the etch chamber.

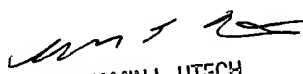
Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner can normally be reached on First Friday.

ltue
March 9, 2002


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